THE RELATIONSHIPS BETWEEN TESTS, MEASUREMENTS AND EVALUATION IN HUMAN PERFORMANCE

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Abstract

In the process of measuring human performance, a number of decisions concerning the methods used and the interpretation of data collection must be made. A wide range of instruments is used to assess abilities in the cognitive, psychomotor and affective domains. It is very important to properly determine the domains where the objectives are planned to be set, develop specific objectives and choose appropriate tests that can objectively, relevantly and validly measure the set objectives. When data are collected, evaluative decisions can be either norm-referenced or criterion-referenced.

Key words: test, measurement, evaluation, norm, criterion

Introduction

The meaning of scientific research work lies in the incessant transfer of findings from theory into practice and also in the search of new challenges in the realm of practice. This involves the continual intertwining and complementing of findings and experience which are tested against scientific methods. Therefore, tests and measurements are also the focal point of our sphere of activity. They are elements of school, competitive and recreational sports, as well as

of the sports activities of people with special needs. In addition to the selection of tests and measurements and the results obtained, the evaluation of the latter is also of crucial importance (Morrow, Jackson, Disch, & Mood, 1995). It is the evaluation that facilitates the designing of an appropriate and individually designed training programme and the choosing of suitable training means and content. For individual subjects, measurements can be carried out in the following areas (Oja & Tuxworth, 1995): aerobic capacity, motor abilities and body structure (body mass index).

Nearly all decisions made in the process of sport-motor analysis of an individual or a group should be underpinned by appropriate measurement and assessment, i.e. evaluation. Figure 1 shows the connections between tests, measurements and evaluation.

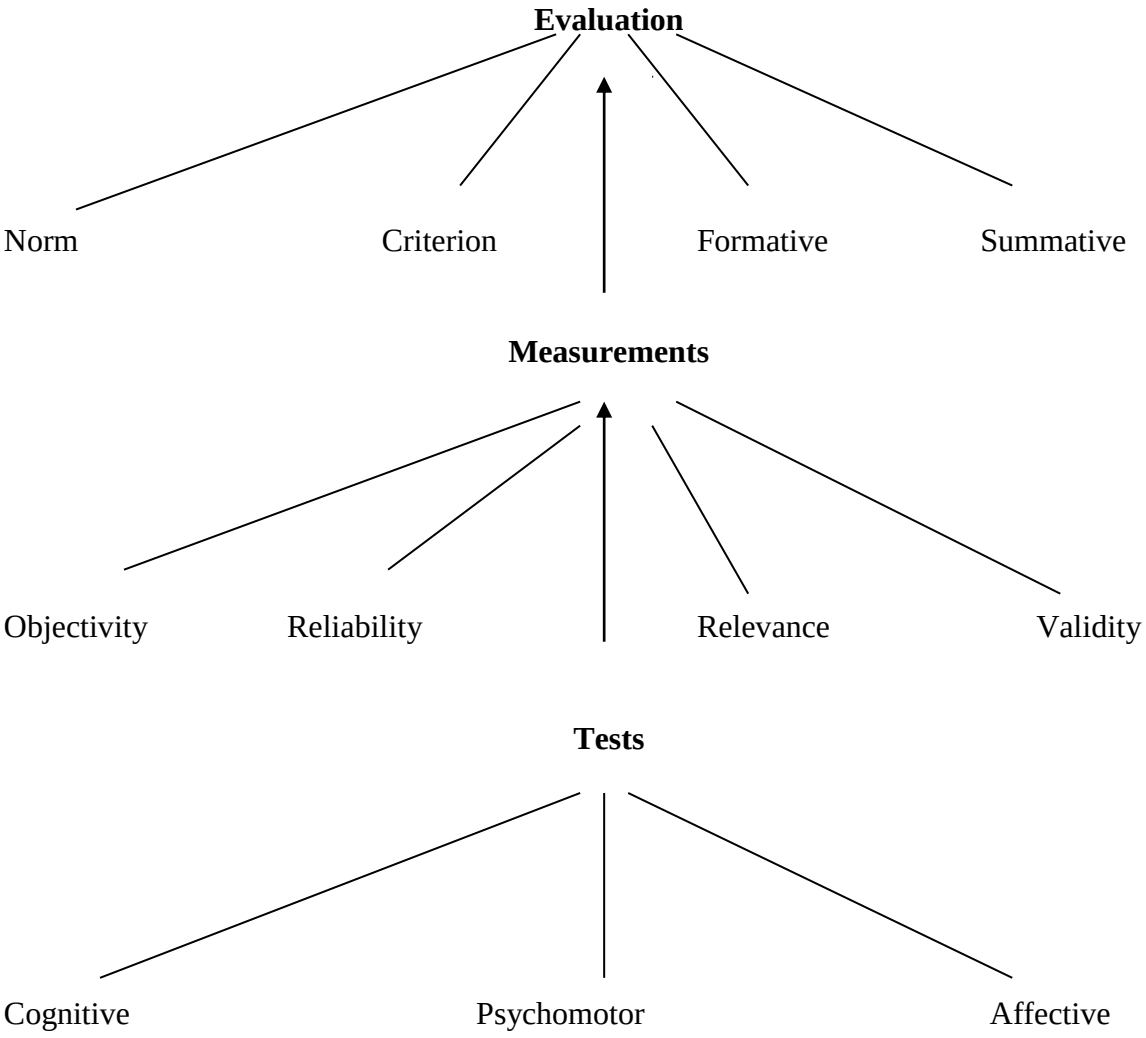

Figure 1. Relationships between tests, measurements and evaluation (adapted from Morrow, Jackson, Disch, & Mood, 1995).

It is evident from the above that the coach, teacher and/or instructor must make a number of decisions when selecting training methods and content, planning the training process and interpreting the data collected from performed measurements. A broad range of measurement procedures and tests is used to define abilities in the cognitive, psychomotor and emotional area. First, one must decide in which of the abovementioned areas the objectives will be set, i.e. which changes in a person's abilities or characteristics will be achieved. Then more specific (concrete) objectives must be defined and such test selected that will offer an insight into the changes of a studied person or group in an objective, reliable, adequate and valid manner.

Once the data are collected, the evaluation should refer to the set standards or criteria. The comparisons referring to norms are those where a person's implementation (result) is compared against the implementation (result) of other people who performed the same test. The standards referring to the criteria are used in the sense of comparing a person's implementation against the pre-defined standards or previous measurements concerning a specific behaviour, characteristic or ability.

The assessment/evaluation can be interim and/or final. An example of an interim or initial measurement is a pilot study based on which individual tests are designed or selected, the measurement protocol defined and the training programme drawn up, etc. In the continuation of the training process, interim measurements are carried out, changes evaluated, the training programme corrected, if required, or upgraded in specific periods of time, e.g. by mesocycle (Ušaj, 1996). Each interim measurement represents a starting point and feedback for the further designing of training programmes for the next training period. Such repeated assessments at intervals should incorporate a formal test, observation, adapted tests and feedback between the coach and the exerciser.

Final evaluation. This yields the final score at the end of a training period. On this basis, plans for the future can be drawn up, underpinned by a preliminary analysis of the training process, training means and content, a person's progress, their motives, wishes, etc.

At first glance, the difference between the interim evaluations and the final evaluation is merely the difference between the interim results and the final score. However, this is not the

case, as the use of data distinguishes between interim and final scores. Scores are obtained throughout the training period on the basis of interim assessments or measurements, whereas the final score is essentially the evaluation of the entire work, i.e. the effects of the training on a person as well as the training process and selected means, content and strategies.

Simple example of losing weight

Example: Body mass and fatty tissue percentage were measured. The initial and/or interim measurement showed 30% fatty tissue. Body mass should decrease by about 8 kg to reduce fatty tissue to 25%. What follows is the formulation of an appropriate, individually designed training programme, with emphasis placed on the loss of 1 kg of body mass every two weeks. In this way a person would lose 10 kg in 20 weeks. In addition to other measurements, the exerciser is weighed once a month, whereas they themselves also control their weight regularly and record results. In this way, the exerciser receives double feedback: that provided by themselves every day and that by us once a month when we carry out the weighing. The results of the interim measurements are compared to those of the initial measurements. On this basis our work is assessed, and the training programme and respective diet corrected. At the end of the planned period, the final measurement is carried out and the final score obtained, which is compared against the initial one. If the loss of body mass and fatty tissue equals the value which was planned jointly with the exerciser at the start, our work is assessed as positive and the set objective is considered achieved.

Examples of research in the armed forces

Liu (2000) exposed the importance of sport in the armed forces. He has analysed the differences between two notions, ‘military sport’ and ‘sport in the military’. Military sport is defined as a specific type of sport, where the training process is based upon combat readiness like that of the Chinese national strategy of defence system, and upon readiness for war or war-like conditions. Sports activities include different types of shooting with combat weapons, parachuting, military pentathlon, etc., and all of them are directly related to the assessment of the soldiers' combat capacities. On the other hand, sport in the military primarily includes the most common types of sport, like football, athletics, basketball, handball, cycling, etc., namely, the types of sport characteristic for ordinary, civilian society. Liu (2000) emphasized that these sport activities in the context of the armed forces do have

certain specifics; at the same time the options are open as to the individual sports soldiers can have in addition to the military sport activities.

Tkavc (1999) defines sport in the Slovenian Armed Forces as an entity, and thus takes up the same point of view as Zechner (Bulletin, 1996). Based on definitions by Liu (2000) – military sport and sport in the military – and according to the purpose of sport in the Slovenian Armed Forces, her definitions could be related as follows. Military sport is a regular sport activity and also serves for assessing motor abilities, while sport in the military represents any other sport activities, ranging from sport for all to sports competitions. Despite different points of view and definitions, it is obvious that there is a universal notion of sport and that the principle goal of sport in the military is the adequate physical readiness of soldiers to successfully attend to their regular and combat duties (Tkavc, 1999).

Bonev (2000) has introduced a systematic definition of the abovementioned physical training factors – commonly called 'physical education' in the military. The author (Bonev, 2000) provided a basic model of sport training that should comprise the following elements: sport training as a part of regular armed forces personnel duties – 2 to 3 hours weekly; morning exercises – 30 minutes; elements of sport for all profiles (90 minutes) to be carried out off-duty; physical training aimed at enhancing combat readiness. Particular elements of training, explicitly emphasized, are athletics, marching various distances, movements with acceleration and changes of direction, sport gymnastics (floor, gymnastics, permitted apparatus adjustments), running, swimming, Alpine and cross-country skiing, rowing, combat sports, etc.

In specific conditions in Africa, Mudambo (1996, 2000) studied the effects of negative energetic ratio on military personnel in 'survival' training in hot weather conditions. The author stresses that in order to prepare soldiers for possible war conditions, the training process should include as many factors as possible (climatic, health-related, etc.) which soldiers would face in war conditions.

Adequate physical readiness is a significant aspect of universal armed forces readiness and an integral part of military support (Jaenen, 2000). Despite an increase in number and enhanced military equipment, mechanisation, means of transport, etc., a number of combat operations still depend on physically well-prepared soldiers (Jaenen, 2000; Karpljuk, Žitko, Rožman,

Suhadolnik, & Karpljuk, 2000). For example, Canadian armed forces personnel (Jaenen, 2000) must be physically prepared to successfully carry out military operations in a geographically and climatologically diverse landscape. All profiles, from officers to soldiers, undergo a highly well-rounded physical readiness program. Their physical readiness is evaluated through various assessments based on the Human Rights Act (Jaenen, 2000), and the personnel are informed about it upon joining the Canadian armed forces.

US army personnel start their physical training program the first day upon entering the forces, and the program lasts until the end of an individual's military career. The athletic way of life in the US army is not an exception but rather a general activity of all its employees. The assessment of physical efficiency is based on the Annual Physical Training test (also used by some NATO members), and is comprised of push-ups, curl-ups and a 3200-metre (2 mile) run (Picarielo, 2000; Karpljuk, Žitko, Rožman, Suhadolnik, & Karpljuk, 2000). Picarielo (2000) stresses that physical efficiency readiness is based on endurance, strength and agility, as well as on developing mental abilities, cohesiveness within a group, and factors related to combat situations.

Karpljuk et al. (2005) did research about the effects of individually designed programmes of physical training based on US army standards on the motor abilities of Slovenian Armed Forces personnel. The aim of this research was to ascertain the effects of a training program, based on individually adapted intensity levels, on the motor abilities of Slovenian Armed Forces (SAF) personnel. The sample of subjects included 34 members of the SAF (16 in the experimental group – EG, and 18 in the control group – CG), aged between 35 and 40. The results were processed by the program SPSS 8.0 for Windows. Data processing was carried out in several phases. First, the basic statistical characteristics and the distribution of individual variables were determined, the measures of central tendency and the measures of dispersion were calculated, and a method of analysis of variance with a 5% risk level was used. The results showed that a characteristic enhancement of certain motor abilities of the sample studied can be improved by means of training process economisation and individually adapted training intensity levels. Statistically significant differences between the experimental and control groups were found in measurements of body fat (KG), push-ups (PU), curl-ups (CU), 3200-metre run (3200MR) and morning heart rate (MHR).

Although the research sample was small, this study at least in theory supports the need for future research in this area, as our evidence strongly suggests the effectiveness of individually designed training protocols on the physical readiness of Slovenian Armed Forces personnel.

Conclusion

No matter which area of our life and work is considered, scientific research work follows similar principles to those which were briefly presented in our article. Thus the findings can be transferred into practice with great certainty, new challenges can be sought and new findings discovered. It is about the continuous intertwining of science, practice and experience to discover new paths. The tests, measurements and evaluation of results form a patchwork to which every researcher contributes with their practical work, thus adding to the explanation of new findings.

References

1. Bonev, I. (2000). *Physical Education in the Armed Forces*. In Mophuting (ed.), 2000 International Scientific Symposium. (6-7) Gaborone-Botswana, 23-27 October 2000.
2. Jaenen, S. (2000). *Physical Fitness*. In Mophuting (ed.), 2000 International Scientific Symposium. (9). Gaborone-Botswana, 23-27 October 2000.
3. Karpljuk, D., Žitko, M., Rožman, F., Suhadolnik, G., & Karpljuk, K. (2000). *Teoretične osnove in praktična izhodišča športne vadbe, namenjene višjim častnikom slovenske vojske [Theoretical bases and practical starting points of sport exercise for senior officers of the Slovenian Armed Forces]*. Ljubljana: Ministry of Defence of the Republic of Slovenia.
4. Karpljuk, D., Dervišević, E., Tkavc, S., Novak, M., Žitko, M., Videmšek, M., Hadžič, V., Rožman, F. (2005). The effects of individually designed programs of physical training based on US army standards on the motor abilities of Slovenian Armed Forces personnel. *Acta Univ. Palacki. Olomuc., Gymn.*, 2006, 36 (1), 29-37.
5. Liu, D. (2000). *The Difference between Military Sport and Sport in the Army.* In Mophuting (ed.), 2000 International Scientific Symposium. (5). Gaborone-Botswana, 23-27 October 2000.

6. Morrow, W.J., Jackson, A.W., Disch, J.G., & Mood, D.P. (1995). *Measurement and evaluation in human performance*. Champaign: Human Kinetics.
7. Mudambo, K.S. (1996). *Energy and fluid requirements and physiological response to heat stress in military personnel during field exercise in the heat*. Thesis, University of Dundee, Scotland, UK.
8. Mudambo, K.S. (2000). *The Negative Effects of Prolonged Strenuous Physical Training on Human Health*. In Mophuting (ed.), 2000 International Scientific Symposium. (18-19). Gaborone-Botswana, 23-27 October 2000.
9. Oja, P. & Tuxworth, B. (1995). *Eurofit for adults*. Tampere: Committee for the Development of Sport and UK Institute for Health Promotion Research.
10. Picarielo, J.M. (2000). *Battle-Focused Physical Training: A Career-Long Commitment.* In Mophuting (ed.), 2000 International Scientific Symposium. (11-13) Gaborone-Botswana, 23-27 October 2000.
11. Tkavc, S. (1999). *Šport v Slovenski vojski [Sport in the Slovenian Armed Forces]*. Bulletin of the Slovenian Armed Forces. 1 (1) 85-95.